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ABSTRACT

A study was conducted to compare five different techniques for determining the best means of assessing a reader's background knowledge and for discovering if it is possible to elicit different amounts of information from the same subject by simply varying techniques. Subjects were 32 third through sixth grade students, divided into groups of skilled and less skilled readers. The five assessment techniques used were (1) a free recall task about snakes; (2) 55 structured probe questions developed from a list of 20 subtopics on snakes; (3) a word association task based on the list of the 20 subtopics about snakes; (4) a recognition task, based on a modified multiple choice format, about snakes; and (5) a relatively unstructured discussion of the child's first experience with snakes. Each subject met individually with the experimenter in five separate sessions. The structured questions elicited the greatest quantity of information or number of facts, followed by the recognition task, the word association task, free recall task, and the unstructured interview. The structured question condition produced both more information and more correct information than any other task. (MKM)

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A Comparison of Techniques Used to Assess Readers' Prior Knowledge

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Many reading educators and cognitive psychologists currently maintain that reading is an active reconstructive process. For this contention to be supportable, both the background knowledge and the experiences brought to the printed message should have a significant effect on the reader's understanding of the message. Evidence of the importance of prior knowledge has been found by researchers such as Anderson, Pearson, Schallert, Brown, and others. Because prior knowledge seems to affect comprehension and learning (Rumelhart and Ortony, 1977; Anderson, Reynolds, Schallert, and Goetz, 1977; Brown, Smiley, Day, Townsend, and Lawton, 1977; Pearson,

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Hansen, and Gordon, 1979; Ausubel and Fitzgerald, 1961), it becomes increasingly important to validly gauge the reader's prior knowledge before an accurate estimate of comprehension or learning can be made. If estimates of reading comprehension continue to be used to assess the effectiveness of programs, teachers, and readers, it becomes increasingly important that those estimates be as valid a sampling as possible.

The primary purpose of this exploratory study was to compare five different types of techniques to determine the best means of assessing a reader's background knowledge. "Best" was defined in terms of quantity of information, achieved by the varying techniques when time of administration and the number of probes were considered. These dimensions were further examined with respect to readers' age and reading ability.

A second purpose of this investigation was to determine whether existing research that has used quantity of prior knowledge to group subjects into high-low categories or as a covariate is valid and reliable. It is possible that if a different type of prior knowledge assessment technique had been used, subjects would have been placed in a different classification and the results would also have been different. Therefore, this investigation sought to determine whether it is possible to "flush out" different amounts of information from the same subject by simply varying techniques. It was assumed that large negative deviances would point to ineffective methods for gauging prior knowledge and that clusters of similar scores may point to more accurate means (by suggesting reliability).

Methodology

Subjects

A total of thirty-two subjects from a summer reading program at the

University of Texas participated in the study. They were selected from those students who would be entering the third, fourth, fifth, or sixth grades in the fall. There were equal numbers of skilled and less skilled readers. Subjects were classified as skilled if they scored on or above their grade placement level as measured by two subtests of the Woodcock Reading Mastery Tests. Less skilled readers were those students who scored one or more reading levels below their grade placement level on the same measure. The subjects' I.Q.'s were assessed by an abbreviated form of the Weschsler Intelligence Scale for Children - Revised. All subjects scored in the average range on this test.

Assessment Instruments

The five assessment techniques were selected from a list of thirty possible techniques collected by the authors from a survey of the literature. The selected five seemed to best represent the basic types of techniques. All five techniques were used to assess students' knowledge of one topic -- snakes. This topic was chosen because of the fascination it holds for most children -- good and poor readers alike. An informal survey of children's interests conducted prior to the study revealed the popularity of the topic.

The instruments were developed using the information contained in children's books on snakes and from encyclopedia entries on the topic. It was found that almost all the sources contained similar subtopics related to snakes (e.g., eating habits, enemies, protection, shedding, reproduction). The twenty most frequently mentioned aspects of snakes were thus identified. These twenty subtopics then served as the basis for constructing the instruments.

Technique One was a free recall task. The experimenter said to each student: "Imagine that on this paper is written everything there is to know about snakes. What do you think it would say? "The only additional comment made by the experimenter was "Are you sure that is everything?" The experimenter wrote down the facts as they were stated by the student. Tape recordings were made of the session to verify the results.

Technique Two consisted of 55 structured probe questions which were developed from the list of twenty subtopics. For example, on the subtopic "shedding", the following questions were asked and the responses recorded as written protocols:

(1) Does a snake keep the same skin its whole life?

(2) What happens to it?

(3) How does it get the skin off?

(4) How often does the skin come off?

If the student responded incorrectly to the first question, then the following three questions were not asked to avoid adding to the student's knowledge.

The third technique was a word association task which consisted of the list of the twenty subtopics. The experimenter proceeded as follows: "Today we are going to play a word game about snakes. I will say a word and you tell me everything you can think of about that word as it relates to snakes. For example, if the topic were cats and I said "paws" you might say: "four of them, have claws, have pads on the bottom, walk on them".

The fourth technique was a recognition rather than a production task. It was thought that some children might have knowledge of snakes but be unable to retrieve the information in a production task. This task had a

modified multiple choice format. There were twenty questions with 55 possible correct responses. As the teacher read the statement, the child was to circle those sentence endings which were true. The following is an example:

Cold-blooded means

(a) having cold blood

(b) having a constant body temperature

(c) changing temperature with one's surroundings

(d) never being too hot

The final technique consisted of a relatively unstructured discussion of the child's experiences with snakes. The child was encouraged to tell about firsthand experiences such as seeing or touching a snake. The student was then asked to tell about any books, movies, museum exhibits, etc. on the topic. With each experience, the experimenter asked what the child had learned about snakes -- if the student had not volunteered the information. There was a list of thirteen questions from which the experimenter could choose to prod discussion.

Even though these techniques were quite different, an effort was made to make them somewhat comparable without losing the inherent characteristics of each technique. The twenty word associations corresponded to the twenty modified multiple choice questions. The structured questions were developed from the twenty word associations giving these three instruments face validity. There were 55 structured questions and 55 possible correct responses on the modified multiple choice questions.

Procedure

Following the initial screening of reading ability and I.Q., each

subject met individually with the experimenter in five separate sessions. These sessions were spaced approximately one week apart. During the first session, all subjects were administered the free recall task. The remaining four assessment instruments -- structured questions, word association, recognition, and unstructured interview -- were administered according to a Latin Square format.

Analysis of the Data

The differences between the means of the techniques were analyzed by correlated t-tests. Two-by-two analyses of variance were also employed to determine significant differences between subjects on each technique. The independent variables were grade (younger or third and fourth graders and older or fifth and sixth graders) and reading ability (more skilled and less skilled). There were six dependent variables. These variables were (1) number of total facts; (2) number of correct facts; (3) number of incorrect facts; (4) time of administration; (5) effectiveness - the total number of facts divided by the number of probes developed for the assessment; and (6) efficiency - the number of facts elicited per minute.

Findings and Conclusions

Significant differences were found among the techniques for all the dependent variables. (See Table 2) The structured questions elicited the greatest quantity of information or number of facts. This technique was followed by the recognition task, the word association, free recall, and then unstructured interview. There were significant differences between each of the pairs of techniques except free recall and unstructured interview. Older students responded with more facts than younger readers on the

structured questions and free recall tasks. On techniques 3, 4, and 5 however, the younger good readers produced more facts than either of the older groups. Main effects for ability were not significant.

The structured questions condition produced both more information and more correct information than any other task. The mean number of correct responses elicited by the five techniques followed the same order as the total facts elicited. There were no significant differences between age or ability for any of the techniques.

The number of incorrect facts produced were about the same for the recognition task and the structured questions condition. The recognition task and structured probe questions yielded 35 percent and 28 percent incorrect facts respectively. In contrast, the less structured techniques yielded very few inaccurate facts ranging from 15 percent in the word association technique to 2 percent of total in free recall.

There were only two significant interactions between grade and ability. They were for total and incorrect facts on the recognition task. The older-poor and younger-good readers gave more incorrect facts than the older-good readers. The same trend held true for incorrect responses on the structured questions. It may be that one reason younger-good readers and older-poor readers are not as successful on reading comprehension tasks as older-good readers is because of an excess of misinformation and misconceptions rather than just a lack of correct information.

The method taking the least time to complete was the free recall. The other methods followed in the reverse order of number of facts elicited. In other words, with the exception of the free recall type assessment, the more information gained, the longer the administration time. Time also

seemed to be closely related to how much the examiner was required to say.

Effectiveness was determined by dividing the total number of facts by the number of probes. This score revealed an estimate of the amount of information gained compared with the effort or time expended in administration. Since free recall required only one probe by the experimenter, it was most effective. Of the remaining techniques, the multiple choice method was most effective and the unstructured interview was least effective.

The final dependent measure was efficiency or the ratio of the total number of ideas to the number of minutes required to administer the task. Therefore, if a teacher found during lesson planning that only ten minutes could be allotted to prior knowledge assessment, this score could indicate which method would probably elicit the most information for that brief period. The structured questions yielded the most information per minute and was statistically superior to all the other tasks except the recognition one.

From these findings, it appears that for complete flushing of the reader's prior knowledge, the structured question technique was the most successful. For finding out children's misinformation, either the recognition or structured question technique provided the best results. For a quick but less thorough assessment for young readers, free recall was the best. Also, to gain the most information with the least preparation time and effort, free recall was superior. On the otherhand, for acquiring the most information per minute, the structured questions and the recognition techniques were most productive. The unstructured interview which is often used in the classroom for motivational purposes, appears to be the least helpful

means of finding out a child's factual background knowledge.

When reader characteristics were examined, older readers tended to perform better than young readers on free recall and structured questions. No significant differences were found between the more skilled and less skilled readers.

Summary

The assessment of one's complete prior knowledge of a given topic is, of course, impossible to determine with current techniques. The best researchers can presently do is to make estimates of that knowledge. By finding similarities in the amount of agreement between and among techniques, we can make guesses at accuracy. Yet these tendencies toward agreement could be affected by the subject matter or topic tapped, the age of the subjects being investigated and by the data-gathering techniques themselves.

From the techniques employed in the current study, it seems evident that the selection of the prior knowledge assessment technique should be dependent upon type of information desired and the time and effort required to build, administer, and interpret the assessment instrument.

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Table 1

Means of Five Prior Knowledge Assessment Techniques

Dependent Variables	1	2	3	4	5
Total Facts	9.52	55.90	24.58	41.60	7.29
Correct Facts	9.36	40.07	20.45	26.77	7.16
Incorrect Facts	.26	15.83	3.87	14.83	.45
Time (in minutes)	3.10	11.50	8.13	10.90	7.39
Effectiveness (Total Facts/Probes)	9.52	1.02	1.12	2.08	.57
Efficiency (Total Facts/Time)	3.37	5.09	3.02	4.06	.94

*1 = Free Recall
2 = Structured Questions
3 = Word Association
4 = Recognition
5 = Unstructured Interview

Table 2

t Values for t-tests Comparing Prior Knowledge Assessments

t-test	Total	Correct	Incorrect	Time	Effectiveness	Efficiency
Tech. 1-2	-16.66*	-15.67*	-9.32*	-8.36	6.00*	-4.26*
Tech. 1-3	- 6.31*	- 6.78*	-3.31	-5.93*	6.03*	.91
Tech. 1-4	-13.74*	-10.55*	-11.21*	-4.51*	5.39*	-1.48
Tech. 1-5	.51	.44	- .54	-4.87*	6.46*	8.75*
Tech. 2-3	6.81*	12.06*	9.33*	1.02	-3.10	7.51*
Tech. 2-4	3.63	6.55*	1.16	- .79	-9.46*	2.59
Tech. 2-5	12.76*	14.77*	9.09*	1.47	6.16*	16.39*
Tech. 3-4	- 5.16*	- 3.79	-4.75*	-2.66	-8.47*	-3.03
Tech. 3-5	12.33*	10.05*	3.03	1.30	8.83*	11.09*
Tech. 4-5	13.77*	12.16	11.43*	3.13	13.66*	10.35*

*p = $<.001$